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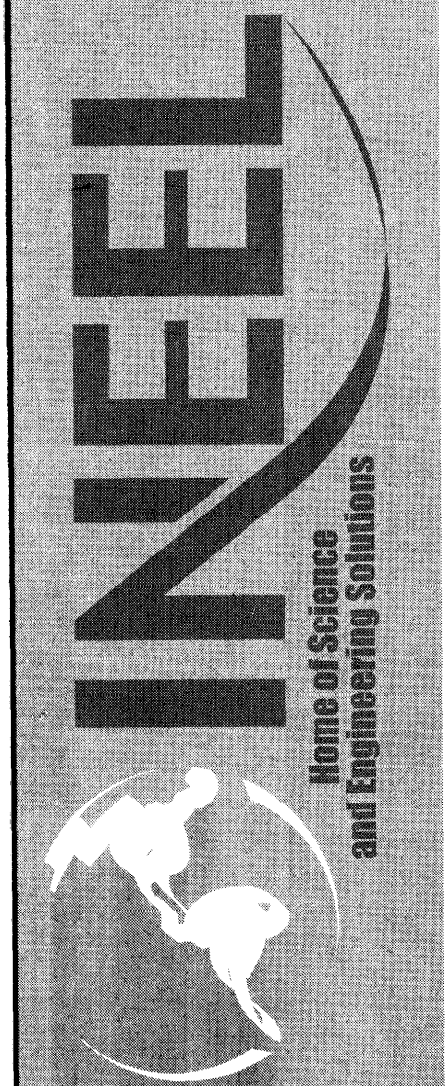

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TASK 7 FINAL REPORT

THE SORPTION OF SELECTED RADIONUCLIDES IN SEDIMENTARY INTERBED SOILS FROM THE SNAKE RIVER PLAIN

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ABSTRACT

Batch kinetic and equilibrium sorption experiments were conducted to characterize the sorption behavior of a selected suite of contaminants (uranium, neptunium, americium, and chromium), which were buried in the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory. The principal objective of this research was to characterize the sorption isotherms for the selected radionuclides under conditions representative of actual field conditions beneath the Radioactive Waste Management Complex and to examine the variability of their sorption behaviors among soils collected at different depths. A secondary objective was to examine the effect of bicarbonate, sulfate, and fluoride, which are common groundwater ligands, on sorption behavior.

Batch experiments were conducted with depth-discrete core samples of sedimentary interbed from beneath the Radioactive Waste Management Complex. Sorbed phase concentrations were inferred from changes in aqueous phase concentrations. The aqueous phase concentration was operationally defined as the remainder after filtration at nominal 12 nm measured by liquid scintillation counting.

Sorption behaviors for ^{233}U and ^{237}Np were nonlinear. The Freundlich and Langmuir sorption models were fit to the equilibrium data. The Freundlich model fit the data better than the Lanmguir model for both ^{233}U and ^{237}Np. Spatial variation of sorption behavior was found to be small for both contaminants.

Carbonate was found to have a strong influence on ^{233}U behavior and masked any effects from sulfate and fluoride. Carbonate, sulfate, and fluoride had no effect on ^{237}Np sorption behavior. The predominant sorbing neptunyl species was predicted to be NpO_2^+.

Large losses of ^{51}Cr and ^{241}Am in blank samples made the determination of their sorption behavior problematic. For ^{51}Cr, the losses were likely due to

The loss of aqueous phase ^{51}Cr was lowest in samples with the highest solids concentration. Additionally, large losses of ^{51}Cr were observed in equilibrium blanks. Apparent distribution coefficients were determined for the samples with the highest solids concentrations to minimize the effect of precipitation and estimate an upper limit of sorption affinity between ^{51}Cr and the soils. The apparent distribution coefficients were small suggesting that the sorption affinity of ^{51}Cr for these soils was small.

Large losses of ^{241}Am were observed in short-term blanks due to formation of insoluble americium carbonates. Consequently, equilibrium studies were not conducted.

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